Interview with CAPT Walt Mazzone, MSC, USNR (Ret.) Sealab Project. Conducted by Jan Herman, Historian, Bureau of Medicine and Surgery, San Diego, CA, 18 March 2000. (1918-2014)

I want to ask you about your background. I understand you were submariner in World War II.

Yes I was a line officer in submarines during the war.

What boat were you on?

I was on the *Crevalle* (SS-291) and the *Puffer* (SS-268). I put the *Puffer* in commission and made two patrols on it and then went to the *Crevalle* and made six more on that. The *Puffer* was a submarine which, on its first patrol, took the longest sustained depth charging.

How long?

Thirty-nine hours and 45 minutes.

My God, those guys must have been cases by the time that was finished.

I didn't give a damn. In every kid movie I ever saw of submarines, they always got up.

Oh, you were on it when they were doing it!

Yes. I was on it. We got ready to abandon ship and all that. My roommate who made admiral but is now dead said, "Here you want this?" and then gave me all his money. I took it and put it in my little safe. Well, when we got back to the surface he says, "Can I have my money back?"

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After the war it was obvious that any kind command functions for reservists not of the Naval Academy were going to be extremely limited. So I got out and went to pharmacy school at the University of Southern California and got a degree in pharmaceutical (unintelligible). Then the Korean War came (unintelligible). (Unintelligible). And we set up a pegboard and I knew where every bed was available in outlining hospitals.

And we made arrangements then to get word from the hospital ship and we would meet and find where (unintelligible). And during that time they disestablished the blood derivatives program.

The blood directives program?

Yes. So I took that over as a contracting officer. I guess I did that for about 4 or 5 years.

When was that?

Fifty-three to fifty-eight. Then one day in '58 I bumped into Harry Alvis in Brooklyn who was an old submarine medical officer that I knew real well. And he said, "What are you doing here?" And I told him. And he said, "You don't belong here. You belong back in submarines. And within 2 weeks I had a set of orders.

So you went to Groton?

I went to Groton. And I went up there ostensibly to head up the School of Submarine Medicine for hospital corpsmen going into submarines. And during that time we established a school of submarine medical officers going into nuclear submarines. I had a hand in setting that up and developing the curriculum.

I had been there just a short time when I bumped into Dr. [ ] Vaughn, and introduced myself and we talked. I asked him where had he been. And he said he just came back from Washington where had lunch with the Surgeon General.

He said, Well maybe I was the lunch for the Surgeon General. I asked him what happened. He said, "I wrote an article that appeared in the paper where I made a prediction that man would live in the sea as a free agent for prolonged periods of time."

This was the *Hartford Courant* piece you were talking about?

Yes. And so we dug it up and read it.

And this was '58?

Yes.

I just want to go back to that. Do you remember when in '58 this article was published?

Probably in June or July because I got up there in October. He told me what his ideas were and I thought they sounded pretty interesting. I asked him if there was any possibility of working with him. He said, "You could help me pull my nuts out of the fire," so I started working with him.

Was this the beginning of the Genesis project?

This was even before Genesis. It was the thought phase. We worked with Dr. [Robert] Workman who was then down in Washington at the Experimental Diving Unit (EDU). He was really our decompression specialist. We exposed some animals in a chamber in New London in the old training tank. We had our own little experimental chamber. We put some animals in the chamber and took them on air down about 100 feet. And they did real well. The next day we looked at them and they were all dead. They had developed some kind of pneumonitis and they all died. Their lungs were all congested.

Then we got to thinking that we ought to look more at this. This was the start of Genesis. We started becoming a little more formal and writing up a little protocol for the animals. And we started varying the gas mix, oxygen to nitrogen. We weren't having any luck at all in surviving animals for long periods of time. Then we go to thinking that we ought to look at helium because Edgar, I think it was Edgar End had done some work with helium earlier. And helium diving was going on in the Navy.

Edgar End?

I think that was his name, yes. I think he did his work between 1935 and 1940, in that timeframe. I forget exactly.

You said he had done some work with helium.

With helium, yes. We started shifting mixes--first 30 percent oxygen and the rest helium. And finally we were able to survive animals for a length of time. Our problem was we had no

way to really control the carbon dioxide. You couldn't ventilate it with air to get the carbon dioxide out.

So we decided to use a submarine scrubber. The problem is we had no way to hook it up, turn it on and off electrically, and then to clean the filter. So Bob Workman and I took out the inserts and we made an outside bubbler, which worked real well. It controlled the carbon dioxide by pulling the helium oxygen through the bubbler and back into the chamber.

And it would just take the CO2 out?

Yes. And it worked real well for maybe 3 or 4 days. Then at 2:00 o'clock in the morning we got a call. You never get an emergency call in the daytime and warm weather. It's always at midnight and the coldest weather of the year. We went there and the CO2 was building up. We found out that the system wouldn't work because we didn't realize that as the carbon dioxide was being removed you were making an insoluble precipitate of lithium carbonate.

In the filter?

In the bubbler. It just filled up with lithium carbonate. But we had enough success to know now that we were getting a good gas mix and we could survive animals. Then we rigged up the submarine scrubber so you could turn it off and on from outside. Then we started having success. The runs were good.

We found that helium and oxygen at say 200 feet using 3 percent oxygen was the equivalent of 30 percent surface oxygen. It had a hell of an effect on the guinea pigs. It seemed to be an aphrodisiac. So we went in there one morning and all these animals were humping. They didn't care who.

Did you say surface air did this to them?

No. We had helium-oxygen at pressure but the percentages were equivalent to 10 atmospheres. It would be like breathing 30 percent oxygen at the surface. You only had a little increased surface over and above what would be breathing on the surface. We used helium as the inert gas with a little trapped volume of nitrogen that you would get with the trapped volume of air when you closed the chamber up.

Now we made a number of runs with goats, dogs, snakes. Any kind of bug that would be walking through the chamber went into a beaker and then into the chamber.

Then it was time to extend Genesis from the mammal. In the meantime there were a lot of negative results that resulted in positive findings. Once you see what's wrong, you can correct it. We could have just said no, it's not going to work. But we would say yeah, we can get around this. So we did that.

And then we got permission to do human runs. We had to do one at 1 atmosphere on helium-oxygen. And then we could go to 100 feet and then we could go to 200 feet. We had the capability at New London to do one of them but we couldn't do the complete evacuation of a chamber and then fill it with helium-oxygen.

So we went to Bethesda and used the chamber there that's attached to a wet pot. What we did was to flood it with water and then we evacuated it with the helium pressure. We laid in helium and forced the water out. Now we had a helium environment.

One-hundred percent helium?

One-hundred percent. Then we put in the oxygen. Then we put people in there. I think we kept them for a week at 1 atmosphere. That's difficult because they could open the door and come out. There was no. . . I think maybe I missed a point here.

The whole purpose of this research was not necessarily to see if we could maintain people under pressure for prolonged periods of time, but to get them back safely. Now how did this start? Well Dr. Workman was one who found that by taking a decompression schedule and extending it over time, that the time penalty after say 10 half lifes--10 tissue half lifes didn't get any worse.

So we said if you can keep them out until they get saturated here then you pay the decompression penalty all at one time whether it be 1 month or 6 months. What we set out to really do was to increase bottom time without increasing the penalty of decompression.

You get a man on the bottom working for 30 days and he would still have the same decompression time as if he had worked for 30 minutes on the bottom.

Well, it would be 10 half lifes which could be a little bit longer, maybe 10, 15 hours -- but yes.

Now, from the beginning, there was no Navy support for this research. This was all something that Dr. [George]Bond and you all decided to do.

That's correct.

Did you have any problems with your commanding officer who might have said, "You guys are working on stuff that isn't authorized and I've got work for you to do?"

No, not really because he recognized the benefit of this research.

So you were lucky. You had a good CO. You could have one who said "I don't want you working on this, period." And that would have been it.

Yes, that's right.

But you said you paid for the food out of your own pockets?

On some of the runs we paid for the food out of our own pockets. We bought the animals. But we used pond animals, too, and we used some donated farm animals. We didn't have thoroughbred blood line animals. But with the goats you had a lung that was nearly as human as you could get.

So once you started showing promise with this, then you went to humans. You came down to Bethesda and got someone at 1 atmosphere--helium-oxygen for a week.

Yes. And then we took them to 100 feet and then to 200 feet. We did the 100-foot run back in New London. What is significant about that is that in the meantime I had gone to graduate school up at Harvard and was assigned an office area used by Lewis Shaw, a medical officer who was there in the 1930's, probably 1933 to 1935 timeframe. There was still a box of papers there containing his notes. I would love to have known this man because he was very methodical. He would come up with an idea and start it on scratch paper. Then he would add to that like an expanded outline. He said he saw no reason why. . . If you could intersect the steps on a decompression stop at a given time, you ought to be able to come up continuously.

I talked to Dr. Bond about it and he liked the idea. We figured that a hundred-foot dive was not that great a risk but we still had to get some proof. So I went down to Washington and talked to Dr. Workman. He gave me a saturation schedule for a large dog.

He was at EDU at the time?

Yes. I went to Bethesda and, after a little cajoling, cut the time down for getting the animal from 2 weeks to 1 day. We got the animals, put them under pressure under helium-oxygen, saturated them, and decompressed them at a continuous rate. It was a success. We got in the car and drove all the way back to New London. We decided to do it with that run so we welded the long handle from the relief valve up on top down to where we had the depth gauge. We put a big magnifying in front of the glass, and then brought them up at about 3 feet per hour or something, continuously not stopping. We got them up in 30 hours rather than 3 days, something that significant.

It was successful, no ill effects?

No ill effects. That became the standard for almost all saturation diving whether it be in the government or outside the government. It was all continuous rate. But we did it by hand and ultimately it got to be an automated process.

Do you develop tables from that then?

Yes. You could do that. It was pretty standard. You can come up an atmosphere in a certain amount of time and it takes you about 100 feet every 30 hours. And so if you go down a thousand feet it's not much different except there are a lot of things that you still have to do. You have to play with the oxygen. It wasn't standard. We found out that if we had divers say at 500 feet and we wanted to bring them up since they were . . . Part of the problems when you start leaving a depth after you saturate, is getting the gas molecules to move back out of the body. And how do you do that? You have to decrease the exposure to the inert gas to a lesser partial pressure so that now it goes the other way.

I talked to Bond about and we tried it. In the morning before we left the bottom I would gradually get the oxygen up to what it should be at the next level. So then we would start traveling. In the meantime we had already started gas going the other way. We started to overcome the inertia of the gas moving. We would keep that going so that when we got to this stop we had the oxygen here. We did a tremendous number of dives after that with no hits.

The gas exchange is to the lungs?

Yes, It's all through the lungs.

All through the lungs?

Yes.

Okay. Helium is being given off.

That's part of the story. Then there were other things that came up. I'm sure you've heard that on later dives the divers complained that when they got to depth, they really didn't feel like doing anything. Their joints ached but they couldn't define it. They described it as feeling that they had no joint juice. So they used to refer to it as NJJ.

No joint juice.
No joint juice.

What was all that about? Was there any physiological reason?
Well yes. I think there was and it was not just pressure. Let's look at the knees. The knees have synovial fluid. The metabolism of the knee is much slower. So we figured that if we go down say 30 feet and we stop, and we adjust the oxygen, and we let them stay there for a while, and let them equilibrate and then go on down--an interrupted stage going down. And it worked. We would get the divers down and they didn't have pain, so they were able to go to work.

The fluid was not metabolizing correctly?
It wasn't equilibrating as fast as we thought it should.

But you solved it with those stops along the way?
Yes. There might not be much rationale for it. But it's the kind of thing that you might read about and you say to yourself hmm, well maybe. So you try it. If you looked at it strictly from the mechanics of the joint maybe it wasn't thought of. It's hard to articulate but it worked. And they still do that. And to me that's proof of the pudding.

Even if they don't know what the physiological reason is, it works. They'll do it.
Right. Now, the other thing is when we started doing some test dives getting ready for Sealab 3 we got approval to go to 1000 feet at one of the chambers there at EDU. We got the divers to 1000 feet. I was a diving officer. The Secretary of the Navy who gave us approval to do it was standing there with me.

Who was that?
[Paul] Nitze. Lugal (sp) was the subject.

Who?
Lugal. And at a thousand feet we noticed that he was . . .So for the first time we knew that there were incontrollable tremors, that the diver didn't notice, but they were there. Dr. Bond was then working for DSSP, the Deep Submergence System people. He said, "Okay you're at a thousand feet, now bring her up."
The Secretary said, "Could you go deeper than that?" I said, "Yes, we can go another 24 or 25 feet. These chambers are built for that." He said, "Do it." I said, "But we need permission." He said from whom? I said, "You." He says do it. So we went to 1024.

What were the tremors all about?
They're still a problem, a high-pressure syndrome of some kind. I don't know. Of course, I left after that and never had a chance to really get involved anymore looking at it.

So the dive was at 1025 feet?
Yes.

Was that a record?

One thousand and twenty-four.

Was that a record?
Yes, at that time it was a record. It has since been beat. But as far as the Navy dive was concerned these were pathways for other people to follow.

Getting back to that dive at 1024 feet, he's in the tank. What merits it as a success? Can he work at that depth?
Oh yes, we put him in water.

And you had some tasks for him to perform?
Yes.

And he performed them okay without any problem?
Oh yes, because we did the complete physiological monitoring all the way through.

Did they have to do a flange or something?
I think we had bicycle riding or something like that. But the fact that we got them down there and back . . .

How long was the decompression period at that time?
I forget exactly. Let's see, we saturated at I think 825 and then made the excursion to 1000 and then to 1024. And then we brought them back to 825 and decompressed them at 825. So I think it was -- I forget exactly--maybe 3 or 4 days.

You needed different tables for that didn't you?
No, no. I have to back up. One of the studies we did in New London that Dr. Bond and [CDR Jackson M.]Tomsky funded, although Tomsky wasn't sure what he was funding at the time, was . . . We knew what man could do breath-holding from 100 feet. And we wondered. If you saturated at a different depth . . If you were at 50 feet, could you go deeper and then come back to that 50 feet without decompression. And so we explored all that. That's where we found out that you could very safely go from 825 to 1025 and come back up without worrying about decompression.

So that's called an excursion because you're going below your prescribed depth?
Yes, and then coming back.

Which would be let's say. . . If you had guys on a submarine, you could hover the submarine, get out at pressure, go down to work on the bottom, and then come back to the submarine.
If they were saturated.

Saturated at the level of the submarine, right?
Right.

But you wouldn't need separate tables for that necessarily?

Well no, no because we determined what the limits were. What's the criteria you always use? Do you have the bends? Well we didn't have any bends. You either hurt or you don't hurt.

By this time you had developed an expertise in diving yourself. You were a diver.
Well, I went to diving school.

When did you do that?
Nineteen fifty-nine.

Where, in London?
No.

At EDU?
At EDU. I went to the diving school there.

So you learned to dive in the Anacostia River?
Yes. And I came out as a helium-oxygen diving officer, a Medical Service Corps officer. And then I went to post graduate school.

At Harvard?
At Harvard in the School of Public Health. But all those times I was coming back on weekends getting ready for Sealab 1.

So by this time, Genesis had run its course. At some point Dr. Bond's, Dr. Workman's, and your project, which had been hand to mouth, out of your own pocket, changed. Someone discovered that you guys were doing some useful work for the Navy and that you should get some funding.
Well, yes. And you got to give Dr. Bond the credit for that. He wouldn't circumvent the chain of command but, through some sort of serendipity, he'd be on the same airplane with the Secretary of the Navy and mention this project. The Secretary would then ask the Surgeon General about it. "Oh, yes I think that's one of my projects."

Knowing full well he didn't have a clue.
He didn't know what the hell was going on. And then we started getting recognition and funding, not huge amounts of money. But then it started taking off. And then Bond got ONR (Office of Naval Research) interested after Sealab 1.

Before Sealab 1.
Oh, yes. He got ONR interested before Sealab 1.

That was due to Bond's political ability.
Indeed.

He went over to ONR and said we're doing this and they saw the value and decided to fund it.

He knew how to schmooze the right people and piss off the other people, but we got it done. Melsen was one.

What was his first name?
Lou Melsen. He had worked for ONR and was the sponsor for the Sealab 1 project.

Once you found out that this was going to proceed what did you all do? How did you get ready for this project? Did Dr. Bond have a list of project goals in Sealab 1?
We did that every morning.

Every morning. You would sit down over coffee and decide what the goals would be for this project?
Today, if you tried to do something, you'd have to get it processed or a procedure approved by 155 people before you could do it. The guy asked how we were going to do the personnel transfer. I said, "One, we're going to rig the chamber for the BTC for diving. We're going to do this, and do this. Two, we're going to lift it off. We're going to do this to put it on that."

So you made an outline on a piece of paper and that was it?
Yes.

That's what you were going to do.
Yes.

You all agreed and that's how you did it?
Yes. You understand that we were taking an experimental program and turning it into real life. And the real life people didn't understand saturation diving and didn't understand that the roads hadn't been paved. There were no standards necessarily except standards of safety.

So they were buying Dr. Bond's expertise, saying the guy must know what he is doing so let him proceed?
Yes. I'd like to think that but I think some of them had the feeling that Bond was a kook. If you talk to them you'll get some impressions. They speak lightly of him sometimes.

Because he was up here somewhere floating around with his ideas.
Right.

But they let him go ahead?
That's right.

Regardless of that, they recognized that he had something there.
That's right, because they also recognized that they he would go around them.

So it didn't matter. If they didn't say yes someone else up the chain would.
Right.

How did you all make the selection for the personnel that would make up the team on Sealab 1?

We needed four volunteers and two medical officers.

Did you have any problem getting them?

No.

Everybody wanted to get involved in this thing.

Yes. We had medical officers volunteering that people don't even know anymore like Al Fisher, John Bull, Dr. [?]Thompson. These people came in, made their run, then went back to work at the hospital.

So these physicians who were involved had to go for diving training at this point, didn't they?

All of them were submarine medical officers.

So they had training.

Yes, they all had training.

Are any of these guys still around? Was it [ ]Sonnenberg?

Sonnenberg is dead. Fisher is somewhere in the Midwest. He got out of the Navy and went into the Army. Dr. Bull is in Phoenix. He has cancer and is not doing well. He came 2 years ago, but can't travel anymore. We have no idea where Dr. Thompson is. He used to live outside of Fallbrook but we have not heard from him in 4 years.

We still have [ ] Lineweaver, but although he has been a submarine medical officer for a long time, he was late getting into the saturation dive program. Dr. Mark Bradley is out of the Navy and working at Johns Hopkins, and he is the consultant for Jack Reedy. Then there's Jim Vorosmarti.

I know him.

He's on the east coast. Dr. Thompson and Dr. Bond were the only medical officers involved with Sealab I.

And Thompson, you say, you've lost touch with.

In the bottle.

Unfortunately, that was Dr. Bond's problem.

He drank a bottle of Old Fifth every day of his life that I know of.

Well, they said that's what finally did him in.

When we went to Bethesda from New London, we went down in the truck because I drove the truck. We were hauling supplies. We stopped outside of Philadelphia. There's a Lansdown turnoff there, and he picked up a bottle of booze. We got to the BOQ and checked in and he poured a water glass full. Then he made one half-part water, half booze. But he just could put it away.

When we went to Washington to do some deep air dives, people had postulated that you couldn't breath compressed air at 450 feet and function. So they rigged up some tests of performance. He and I went to Washington and went down in the chamber to 450 feet breathing helium-oxygen on a mask with a tender. The compression medium was compressed air so when you took the mask off you were essentially breathing compressed air at 450 feet.

We had a series of tasks to do. Sometime during this task they were going to try from the outside to get you not to do something that you had been trained to do. I functioned maybe 2 1/2 to 3 minutes. And they asked me to do something and all I did was . . . and then I was out. But Bond just sat up straighter and straighter and functioned. He said it was because he was permanently narcotized.

Permanently narcotized.

Yes but he…

Well this was the nitrogen that was doing it, the narcosis was doing it but they said that he was permanently that way. So he could do it and didn't have any problem with it. He was used to it.

Well the more he drank the stiffer he got and the straighter he stood. Everybody else would get sloshed. Not him.

Getting back to Sealab 1 again. You got your volunteers and the habitat itself.

The habitat itself.

How was that obtained? How did you do that?

We got the habitat through ONR. They found one of those big harbor net buoys down in Panama City and it was modified into the habitat. It was put up on legs, a lower access was put in, a hawse pipe installed to run the cables up, and portholes installed. And that was the Sealab 1 habitat. We put in a lithium hydroxide manifold to take care of the carbon dioxide, cooking facilities.

And this was off of Scripps Canyon?

No. Sealab 1 was off Plantagenet Shoal in Bermuda.

Oh Bermuda I'm sorry you're right. It was 2 that I was thinking of.

We had one team down. It was a single lock chamber. We put the habitat down with some difficulty, but it got down. And then we put the divers in the single lock chamber, shut the door, pressurized it, took it down, opened the door, and let them swim over to the habitat.

What was the depth at this time?

Maybe 193 feet. Bond and I went down first, went in, inspected the habitat, then came back out, got in the chamber, and came up with a little decompression dive. Then we sent the subjects down.

What was the decompression time on that 193 feet?

I don't remember.

It wasn't long, though?

No. For a depth of 200 feet it's something like 20 minutes decompression.

So you had your volunteers and they started doing chores on the bottom?

Yes. But then we needed support divers so other diving activities sent people in. EOD and some divers came down from Puget Sound. Our support divers were all volunteers from their commands.

ONR was funding this. Did they have any help from BUMED at all, except for the personnel part of it?

I think only the personnel part. They didn't do that much even for the personnel part because most of the subjects came from New London itself--from the subase itself.

So they funded their own?

Yes, but we had to get money from BUMED to fund the travel and all that. You had to get them down there, but I think we went down in a government plane, anyway.

How long did Sealab1 last on the bottom? How long was the experiment?

We were going to go for a week on the bottom but then the storms were coming up so we brought them up a little earlier. We got them up on Argus Island, which was an offshore tower and we decompressed them. We brought them up vertically, and then once it got up, we rolled it over horizontally and then made it into a decompression chamber.

And what was the length of the decompression?

I don't know. I think maybe a day, 30 hours or something like that, maybe a little longer.

But the results from that were completely successful. Hey, people can live in almost 200 feet of water with almost no problem, can function, and everything is great.

We proved that you could put men to the bottom of the sea at 193 feet or in that range and sustain them for a period of time, get them back safely. So now what do you do next? Well the next question was: Can we take that Sealab team down and have them do meaningful work and get them back? So that started Sealab 2. They then built a habitat for Sealab 2, and we went into multiple teams.

There were three teams, right?

Three teams, and they each were going to be down for 2 weeks. Now bear in mind that we were still under ONR. Tomsky and DSSP were not involved, but we had big support from the Naval Ocean Systems down here in San Diego, and Scripps. That's the one we did off of Scripps Pier. I guess it was a little over 200 feet on the edge of the canyon.

By that time we had a new personnel transfer capsule, more to the design of what we thought it ought to be. It mated with a deck decompression chamber so we could bring it up, put it on the deck, mate it with the decompression chamber, drop the people in, close it, and then decompress them.

So, we did the first team, and had all kinds of chores for them to do. I mean good tasks to do. And they were able to do their work.

Scott Carpenter was on this one and he stayed for two cycles.
Yes, he stayed for two runs.

But you said he wasn't any more spectacular than anybody else?
Personality wise, yes. He had a lot of charisma and all that, but I think his work contributions were no greater than any of the other aquanauts.

But he was the most public member of the crew. If there was any press on the outside he was getting it.
Yes, and I suppose that's logical. He was a known name. And we had hoped that it would help bring us some recognition and more funding.

But it didn't necessarily?
I don't think so but then you'd have to ask Thompson. Carpenter had come down to Panama City to do Sealab 1 but then he got hurt on a motorbike or a motor scooter and was air evaced. So we did that one without him. But with Sealab 2 he was a team leader and stayed down for two runs.

If it was a 2-week cycle, he was down for a month.
Yes.

Obviously, with no ill effects?
No, I don't think so, although he did complain of some leg aches when he came out. I don't think we treated him. We had one treatable casualty--Bob Sheets. Bob Sheets had been bent a couple of weeks before in a dive at Keyport, Washington. When he went into the chamber I said to Dr. Bond that if we had a hit it was going to be Sheets.
Well, the last morning of the decompression, about 2:00 or 3:00 a.m., we heard,
"Topside?"
"Yeah, what is it?"
"This is Bob. I got a little twinge in my knee."
We moved everybody out of the main chamber into the decompression chamber and continued decompressing them to the surface. We took him to depth and treated him and then brought him back by himself.

You had to take him down deeper?
To the depth of relief.

When the twinge disappeared you were at the depth of relief?
Yes. "Do you hurt?"
"No. Okay stop." You stay there for a while and let him equilibrate and then start back up. And if you don't hurt, fine. Now if you are at a point when you can go on oxygen, you go on oxygen. It was really an uneventful dive. It was difficult only because we now had two decompressions going on, one in the lock where the other divers were, and the one for the treatment.

So that was really the only complication you had on the whole dive.

I think so.

So after 2 weeks, after these teams came up and they decompressed it was fine. And you started talking about Sealab 3 at that point?

Well, Sonnenberg went down again but not for 30 days continuous.

He was on the first and the third?

The only problem we had with Sealab 2 was the hardware. The helium was diffusing through the gaskets. Helium will diffuse through glass if you're not careful. And all the rubber gaskets were like a neoprene, and helium would just diffuse through it.

Was the hardware different in Sealab 2 from that in Sealab 1?

Yes, totally different because it was a different vehicle, a different habitat.

I mean the breathing apparatus.

Yes. We had a different breathing apparatus. We had the rebreathing apparatus on Sealab 1. One of them didn't function properly for the guy named Tiger Manning. He blacked out and they pulled him in. They took the mask off, got him back on breathing the atmosphere in the chamber, and he came around. But he was so close that his eyeballs were black, absolutely black.

Ruptured vessels?

Yes. I'm not going to say whether he had any residual effects, but he left the program after that. And he's been very, very quiet. We've hardly heard from him. He is somewhere in the midwest. Bart talks to him once in awhile but I think that's as close as you can come to death and he didn't want to do it again.

I can't say I blame him. When did they start discussing the Sealab 3 project? The goals obviously were to take them down to 600 feet.

Yes and to do work. And do the multiple transfers.

Now this is where the funding changed?

Yes.

It was not an ONR project.

No it came through the Office of Special Projects. And there was more money then they knew what to do with. That was part of the problem.

Had it ceased to be something you could control anymore?

When you were walking and then moving a little faster it was great. But when you started to run before you realized that you had to take your legs with you, there were problems. We started going deeper. We went to 600 feet. We were not being assured that the technology was there. We had no hot water suits that really worked. We had no way to keep the diver warm. At that time we didn't realize that you needed to heat up the breathing media to be comfortable. We didn't find that out until later on.

I had been out of the Navy and went to work for Taylor Diving for a month as a consultant on a dive. It was a deep dive, and we saw some of the same problems. Then I went to Duke University. We did a dive there for the Supervisor of Salvage. The chamber was chilled and the gas was cold and the divers were having a problem. I remembered that many days when I was back in New London when I walked out of the house during the winter and took that first breath of air, I started coughing. Well, what they were doing reminded me of that. So I said maybe the gas is cold. So we put hot water around it and it was better, but just in that short distance of hose the temperature equilibrated back to cold again. But because we had a little bit of success, that started a whole new thought process.

You began to heat the gas at the source?
Yes. Closer to the mouth.

Oh really, closer to the mouth?
Well yes because you could have nice warm air. But by the time it got up through the hose, the heat would dissipate right through the hose.

But you couldn't heat it at the source above?
No, no, no.

It didn't work.
You could heat at the surface but by the time you got to depth it was cold again. When we did Sealab 1 and were successful, a guy by the name of George Wiswell from Connecticut came to New London and talked about it. We showed him what we did and how we did it. He went back and talked Westinghouse into building a complex for him. And he did the grade clearances on the Smith Mountain Dam in Virginia. I guess that was the first saturation dive that we know of. Instead of taking months to do it, he did it in a few days or let's say a couple of weeks. I don't know the exact time frame.

You're talking about a fresh water source now. Was there a difference in the table between fresh and salt water?
There is on regular diving but it didn't seem to make that much difference in saturation diving. I brought up Wiswell because he developed the hot water system.

For warming?
For keeping the divers warm. He would run the water down and it would go around their legs and they'd come out. It was like they peed in their pants. They were nice and comfortable, well, reasonably comfortable. When we got back out here I talked to Dick Long and got him started on that hot water stuff.

But you didn't have the problem with heating the suits on Sealab 1 because of the depth?
The water was warm. You didn't even need a wet suit.

But when you got out here and worked at this depth, cold water became an issue.

Yes, but one of the things we were doing out here was using a compressor in the habitat to pump habitat gas mixture to the diver who was doing the excursions. And so he was getting a good fresh supply.

It didn't have to come from the surface.

No, it came from there. And it was being pumped right into his bags, and he was breathing right from the bags. We didn't notice a real problem then due to the cold gas mix.

When a diver was ready to leave the habitat on Sealab 2, he would suit up and then go through a lock?

No.

He didn't have to. He just swam out and up.

He just swam out. You'd go out through the hatch right into the anti shark chamber--the cage--and then out that door.

And then up?

Yes.

When the divers first came down from the surface to go into the area, how did that work?

You put them in a personnel transfer capsule and brought it down. The first diver would take a line over with him from the personnel capsule and hook it.

But they were already suited up in the capsule?

Oh yes. They were ready to go.

With their masks and everything, ready to go?

Ready to go. And then they would swim over and enter the habitat. First they had to open it up and then they would go in. Bond and I went in first.

And once you were in the habitat, what was it like in there?

It was just like being in a room.

You climbed up a little incline or something?

You went up a ladder.

And once you were in there, you could shower, change, and do whatever you wanted to do.

Just like a house. It even had a hot water shower and a toilet.

But you were on helium-oxygen and talking like Donald Duck.

The sound was all different; you were a little colder because heat dissipates faster. And your metabolism seemed to increase because it seemed like you were always eating. At one point, one of the psychologists made a study of how many times the refrigerator door opened and closed.

So they were always hungry?
Yes.

There was a speech problem with the helium.
That was a son of a bitch.

They couldn't understand each other at first.
Hardly, but they got used to it. We had somebody from an applied research lab that came up with what was supposedly a helium speech unscrambler, and it worked reasonable well but you still had to sort of guess.

Guess at what they were saying? At the surface you guys were probably laughing your heads off listening to these guys.
Not really laughing because we had a problem understanding.

Trying to figure out what they were saying.
Yes.

Were these conversations ever recorded?
Oh, yes, but I don't know where they are.

It would probably be interesting to listen to those at some point.
Well, yes because they recorded Carpenter playing the ukulele and them singing "Goodnight Irene."

So Sealab 2 was as successful as Sealab 1 had been?
Yes.

You had no major problems. People could work on the bottom at 600 feet without any ill effects.
Yes.

And then you started moving on to Sealab 3, but at the point you started losing a little control of the process.
Let's not say that. Let's say that the control shifted from the medical people that were doing it to the operational people because it was going operational.

They knew that they were on to something good. You guys had given them a lot of material.
I think so.

And at that point they had other ideas about how they would use the data.
I don't think anybody really realized what that process meant to the offshore at that time. But it was getting very, very close because people like Cousteau and Ed Link had made inroads into this process. Whether Bormann will tell you or not, he went to work for Ed Link. He took

this limited technology we had by then to Ed link. [CAPT Charles, MC, USNR] Charlie Aquadro took it to [Jacques] Cousteau.

It became obvious to Bond and me that . . You see, Bond and I were basically the only watch standers we ever had--day and night. We didn't have any other watch standers. And so he and I would talk a lot, and we began to realize that there might be more to this than people thought, that this process could really push exploration up the continental shelf because you're only talking 600 feet. Oil-drilling didn't really occur to us too much, but mining did and things like that.

But, in the meantime, people left EDU and went to diving companies. They had this smattering of saturation diving knowledge and then the oil companies started picking it up. I think Taylor Diving was one of the first.

But certainly the operational Navy or the people who were starting to think in terms of secret operations, the tapping of Soviet cables, whatever they were planning on doing, now they had the knowledge. You guys provided them with the knowledge to do that kind of work.

The tools. We gave them the tools.

What was the name of the support vehicle for Sealab 2?

That was the *Burkone*.

It was named for you and who else?

Joe Burkage. Joe Burkage was the support guy from the Naval Ocean Systems Center who was up at Long Beach supervising the work on the habitat. And he worked literally night and day. The first day I came in TAD from New London . . . I got in there about 3:00 in the afternoon and we worked until 1:00 in the morning. Then I went and checked into the motel. He went home. Today, he lives in Arcadia, north of Pasadena.

And we met back at 5:00 in the morning and started working, and went until 8 or 9:00 at night. And it was like that every day. He would just bust his hump. We were sitting there one day and said we ought to name this . . . There was a complex. They had three barges tied together with the chambers on it. "Let's just take "Burk" from Burkage and "one" from Mazzone, and we'll call it the *Burkone*. So then Lou Nelson, CAPT Nelson got up, he said, "Yes we have our support ship called the *Burk 1*."

The Burk 1, yes, that's what it looks like.

So that's where it came from. I noticed that even in Carpenter's book he called the support craft the *Burkone*.

And at that point you were just transitioning into Sealab 3. The habitat was down, you were ready to go, and then this terrible tragedy occurred.

I can't even talk about that part. I know what happened and I can't tell it.

That's fine. I don't want you to have to talk about it.

It would just create a lot of hardship and guilt feeling and I don't want to do that. There's really no benefit to be gained by telling.

Will there ever be a time when you will talk about it? Not with me necessarily but with anybody, just to set the record straight?

Probably not. What would be gained by doing that other than creating a lot ill feeling and hardship and problems for other people? And I don't want to do that. But it galls me at times when I hear things that I know are not true.

Obviously, the whole thing was devastating to you guys.

Maybe the people that caused some of the problems don't realize that the decision they made at the time was based on wrong interpretations of what they saw. So you have to weigh those things. It resulted in a couple of us getting letters of reprimand. Mine was because I allowed the divers to go separately. Well I didn't allow the divers to go separately. I gave them instructions before they left the deck decompression chamber to go down, but each did his own thing. And so when [Berry L.] Cannon got in trouble Bart was over at the habitat already instead of waiting for him. If he had been waiting for him where he was supposed to. . .

He would have seen the problem.

He would have see the problem and recognized that right off. But you can't tell that story and you can't print it.

The whole reason for all of these oral histories is the fact that this history isn't written down anywhere. Nobody knows this stuff. Everything is in your heads.

People have been trying to get me to sit down and write a book and maybe I should. I should just sit here and write whatever I think is a chapter, and send it to you or something.

Well, I'll tell you that I would encourage it.

There are a lot of humorous things that happened that are not recorded. Bart brought some of them out.

This is a chapter in Navy medical history that nobody knows. You guys know it and it comes out at the reunions, but that's it. It's only the people at reunions that tell these stories. The public, the line Navy, the submarine medical officers who are running around today have no idea what went on in 1968. They don't have a clue.

Well the fact is, I'm an outsider; I'm not a diver. My whole connection to all of you is through Bob Bornmann. We talk to each other a couple of times a week and he's been teaching me about the diving tradition in the Navy, the medical stuff. He tried to get me to attend the last reunion but I couldn't make it. He said "I'm going to drag you to this one. You're the historian, and you need to know this. And then it's your job to let other people know what we did back then."

The people on the operational side have no concept of what we really went through to get them to where they are. If they did they would have looked at things a little bit differently. We had a lot of experience with helium and knew what it would diffuse through, and knew that if you had to vent something and it didn't vent you would wonder about it. In the new thing we didn't test stuff like that.

So when they made the new habitat for Sealab 3 you guys weren't on the scene?

Oh, we were there. I was up in San Francisco most all the time. I had a lot to do.

So you had input into this?
Oh, yes.

The problem with the faulty workmanship, the sloppy stuff the yard did on the. . .
No, not necessarily. I know it sounds maybe kind of stupid but, as an example, we probably had more experience trying to control carbon dioxide in a helium atmosphere than most anybody at that time except in a diving suit where they used sodasorb. An engineer would develop a whole new idea for a canister that didn't take into account that CO2 is a surface absorption so the more surface you had the better off you were.

And when you get into these kind of arguments. . . No you can't do it that way because we know that the absorption of carbon dioxide is not exponential. It doesn't get greater on a single surface. You need a multiple surface in order for it to get exponential.

In other words, you're arguing with engineers who are giving you the theory. You're arguing from experience because you've seen it happen.
Yes. That's probably the best way to say it. There are laws of physics, but you have to break it down sometimes. Yes. This applies here. It's like, it takes 9 months to have a baby but you can't get nine women and punch it out in one month.

I was a great one for knowing where every single valve was, what it was supposed to do, and when it was supposed to do it, and lining up systems. However, my role had been dimensioned. They made a dive with it in the dry dock and flooded the chamber because they forgot that behind the hatch was a valve that was left open. But nobody wants to say, "Well that valve was open. For some reason it leaked."

No one wanted to admit to a mistake.
That's a hard thing to get people to do.

If you make a mistake you get relieved.
During the war, my submarine training was such that I rigged the compartment for dives so many times I could do it blindfolded, but didn't dare not have the checkoff sheet in my hand. If the old man ever caught you without that checkoff sheet and you were rigging for a dive he'd have your ass.

I want to take you back for just a minute because we left things hanging on Sealab 3. The whole thing was prepared, it's put on the bottom, you send people down, and you have this tragedy. And then it was brought up and there was all kinds of goings on to determine what happened--the board of inquiry and all that kind of stuff. In the meantime nothing was happening. And at some point they pulled the plug on the project. They said that's it. There won't be a Sealab 3. How did that happen? How did you hear about it? How did they tell you it was finished?
It was very simple; there was nothing else scheduled. They started the saturation dive school going. They had the *Elk River* (IX-501) down there and were doing their saturation dives on it. In the meantime I went to the project up there and didn't know what the hell was going on down here because I was inside of a building, inside of a building.

So you just didn't hear any more?
I didn't hear any more.

There was no announcement that the project was finished? That was it. It just stopped?
Well, yes. And then I went to New London and it was over.

You guys had to be terribly disappointed? You worked so hard on this thing.
Oh yes, sure. I think everybody was sort of let down.

Was there ever an official explanation?
If there was I wasn't here. After the hearings, I got a set of orders. It's a difficult thing. [CAPT William M.] Nicholson wanted Bill Leibold to take over and get it straightened out.

Who was Nicholson?
He was the head of the DSSP. He was Tomsky's boss. He was from the old school. It was his opinion that the old time divers ought to be in this program because they could straighten it out. Then I went to the special projects up there for DSSP and then when that was started I got ready to go to New London. But once the word came out that we were going to do other things, it was pretty obvious that there was going to be no more Sealab.

Was the Board of Inquiry here or on the East Coast?
Here. And the thing that pisses me off is that the guy doing it said, "I don't know why you are here but I need you."

He said that to you?
Yes, in court. He said "I need you to answer the questions . . .when there is a discrepancy on what valves do."
We didn't think it was going to be that serious. When you get a letter of reprimand you get a letter of reprimand. But it was too late anyway. I was ready to get out.

That was '69?
Yes. I got out in '70. But from '40 to '70 was enough, anyway.

I'm thinking that they just used that tragedy as an excuse to stop the project.
It was an accident that never should have happened. There were two people on the outside and one on the inside that didn't check the canister. And I wasn't even there. I was in bed.

So you retired.
Yes. And then I went to work for the Naval Ocean Systems Center in 1970.

As a civilian?
Yes, in ocean engineering. I did that for 10 years and then went to work for Science Applications. Then 2 years later they called me back to the lab again as a reemployed annuitant. I stayed there for 3 years then went back SAIC and I'm still with them.

And you're still having fun?

Yes, I enjoy it. But you know, I sometimes think back on all that happened.

Have you thought about writing your memoirs?

Yes, particularly the Sealab stuff. The submarine stuff Bill Rou (sp.) has already written a lot of that and memories have changed.

So what keeps you from doing it?

I don't know maybe just . . . I guess the thing that keeps me from doing it is the question: Is it important for other people to read what I write? Would I be telling them something they don't know?

Oh yes. I would argue the answer is an unqualified yes.